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A Survey of Sex Chromatin Abnormalities in Mental Hospitals

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Sex chromatin surveys have shown that an additional X chromosome is present in some or all of the cells of about 1 in 500 newborn males and of about 1 in 1000 newborn females, and that these anomalies may be 4–5 times commoner in inmates of mental deficiency institutions. The present survey was undertaken to determine the frequency of X chromosome abnormalities in patients with other mental disorders. It soon became obvious that the incidence was greater than that in the newborn population, and that it varied considerably from one hospital to another. The survey was, therefore, extended to embrace a population sufficiently large to eliminate gross sampling errors. Results were obtained in 6000 male and 6241 female in-patients of mental hospitals in Scotland, and in 966 female outpatients of a psychiatric clinic.

Techniques

A modification of the buccal smear method of Moore and Barr (1955) was used to determine the nuclear sex (Maclean, 1966). Chromosomes of blood lymphocytes were studied by a modification of the technique of Moorhead *et al.* (1960). The method of Harnden (1960) was used for fibroblast cultures of the skin. Physical examination of patients with abnormal buccal smears was carried out by one of us (D.J.M.), and their psychiatric assessment was given by the Physician-Superintendents of the hospitals concerned. Analysis of diagnostic categories in each hospital was supplied by the Research and Intelligence Unit of the Scottish Home and Health Department.

Results

Males. 30 of 6000 males were chromatin positive (0·5%). Chromosome studies were carried out on 28 of them, and the results of these studies are given in Table I. 19 proved to have an XXY sex chromosome constitution. 5 (Cases 22–26) had both an XY and an XXY cell line and one of them (Case 24), who was the father of 2 children, has been reported in detail (Court Brown *et al.*, 1964b). 2 additional patients (Cases 21 and 27) had more complex forms of mosaicism. One mentally defective patient (Case 28) had an XXXY/XXXXY sex chromosome constitution. In Case 20 the nuclear sex was at variance with the apparent chromosome constitution. Only an XY cell line could be demonstrated in cultures of the blood and skin, and no drumsticks were seen in 1000 neutrophil polymorphs, but buccal smears were chromatin positive on repeated occasions. The patient was mentally defective and psychotic, with a history of congenital syphilis and no signs of hypogonadism. It is evident that in this patient XY cells predominate, but it is presumed that another cell line, probably XXY, is also present in some of the tissues.

In 2 patients it was not possible to obtain material for chromosome studies. In one of them, 49% of suitable cells of the buccal smear were chromatin positive and the sex chromosome constitution is assumed to be XXY. In the other, only 13% of suitable cells of the buccal smear were chromatin positive. Such a low proportion of chromatin-positive cells in satisfactory buccal smears has in past experience in this centre been indicative of mosaicism (Court Brown *et al.*, 1964a; Maclean, 1966), and in this case the most reasonable presumption is that both XY and XXY cell lines are present. Of the total 30 chromatin-positive male patients, therefore, 20 are presumed to have an XXY sex chromosome constitution, and 10 to have more than one cell line.

Of the 30 chromatin-positive males, 10 were mentally defective and 2 of these were also believed to be suffering from schizophrenia. 11 others

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TABLE I

SEX CHROMATIN POSITIVE MALES IN MENTAL HOSPITALS

Case No.	Date of Birth	Sex Chromosomes		Percentage of Oral Cells with Barr Bodies (BB)			Marital Status*	Gynaecomastia	Psychiatric Diagnosis
		Blood	Skin	1 BB	2 BBs	3 BBs			
1	23.2.1911	XXY	XXY	70			S	—	Mental deficiency; schizophrenia
2	19.6.1913	XXY	XXY	49			S	—	? Schizophrenia; deaf mute
3	15.9.1912	XXY		61			S	—	Mental deficiency
4	25.3.1889	XXY		40			S	—	Schizophrenia
5	10.11.1904	XXY		48			S	—	Schizophrenia
6	16.4.1884	XXY		61			M	—	Arteriosclerotic dementia
7	26.6.1913	XXY	XXY	60			S	Slight	Mental deficiency with mania
8	22.1.1879	XXY		44			S	—	Senile psychosis
9	7.2.1905	XXY	XXY	45			S	—	Mental deficiency; paranoid schizophrenia
10	3.1.1887	XXY		50			M	—	Arteriosclerotic dementia
11	15.5.1893	XXY		53			M	Slight	Delusional insanity
12	10.9.1899	XXY	XXY	35			S	Marked	Paranoid schizophrenia
13	8.4.1921	XXY	XXY	51			S	Slight	Paranoid state
14	11.6.1904	XXY		68			S	Slight	Schizophrenia
15	22.1.1913	XXY		60			S	—	Mental deficiency; chronic alcoholism
16	14.9.1916	XXY		62			S	Marked	Epileptic psychosis
17	15.3.1944	XXY		52			S	—	Psychopath
18	8.12.1904	XXY		59			S	Slight	Schizophrenia
19	28.8.1924	XXY		69			S	Marked	Mental deficiency
20	23.3.1913	XY	XY	30			S	—	Mental deficiency
21	8.8.1893	XY	XO/XY/XXY	44			S	Marked	Epileptic insanity
22	4.5.1887	XY/XXY	XY/XXY	44			S	—	Schizophrenia
23	30.9.1909	XY/XXY	XY/XXY	56			S	—	Epilepsy
24	11.6.1898	XY/XXY	XY/XXY	52			M	Marked	Paranoid schizophrenia
25	12.8.1898	XY/XXY		48			S	—	Delusional insanity
26	1.7.1887	XY/XXY	XY/XXY	48			S	—	Mental deficiency; cerebral arteriosclerosis
27	20.1.1909	XY	XY/XXY/XXXY	18			S	—	Paranoid schizophrenia
28	10.5.1937	XXXY/XXXXY	XXXY/XXXXY	47	33	7	S	—	Mental deficiency with mania
29	1898	NO CULTURES		49			M	Not known	Mental deficiency
30	2.2.1925	NO CULTURES		13			S	Not known	Paranoid schizophrenia

* M, married; S, single.

also suffered from schizophrenia as their major disability. 3 additional patients suffered from epilepsy, and the remainder from a variety of disorders including cerebral arteriosclerosis (2 cases), senile psychosis (1 case), psychopathic personality (1 case), and 'delusional insanity' (2 cases).

Females. Of the 6241 female in-patients, 15 (0.24%) had 2 sex chromatin bodies in some of the cells of their buccal smears, and 2 of the 966 (0·21%) out-patients were similarly affected (Cases 41 and 46). Thus, 0·24% of the 7207 women examined while they were under psychiatric care at Scottish Mental Hospitals had 3 X chromosomes in some or all of their cells (Table II). None of the other women was chromatin negative or had sex chromatin bodies which were thought to be abnormal in size.

Chromosome studies were made on 16 of the 17 women with abnormal buccal smears. 12 of the 16 had an uncomplicated XXX sex chromosome constitution. 2 (Cases 43 and 44) had both XX and XXX cell lines in blood and skin cultures. Cases 45 and 46 were examples of XO/XXX mosaicism. Chromosome studies could not be made in Case 47 and it is not possible to be certain that in her case XXX is the only cell line present.

Of the 17 female patients with abnormal buccal smears, 4 were mentally defective, and 3 of them were unstable, one depressive, another psychopathic, and the third schizophrenic. 6 additional patients suffered from schizophrenia, and 3 more had depressive illnesses. Cerebral arteriosclerosis was diagnosed in 2 of the 4 remaining patients, and senile psychosis in the other 2.

Classification by Disease. The analysis of the various categories of disease is based upon a classification made in accordance with the International Classification of Disease, 7th edition, at about the mid-point of the survey (June 1, 1963), a time when 6343 males and 7028 females were resident in the hospitals surveyed. Complete survey was not possible for a number of reasons: in some cases the patient refused consent for the examination; in others the patient was for one reason or another out of hospital at the time of the visit; other cases were lost when unsatisfactory initial buccal smears could not be repeated because the patient had been discharged. Results were in fact ob-

TABLE II

FEMALES WITH ABNORMAL SEX CHROMATIN UNDER PSYCHIATRIC CARE

Case No.	Date of Birth	Sex Chromosomes		Percentage of Oral Cells with Barr Bodies (BB)		Marital Status	Menstruation	No. of Offspring	Psychiatric Diagnosis
		Blood	Skin	1 BB	2 BBs				
31	26.5.1893	XXX		53	33	S	Never	0	Melancholia
32	4.1.1921	XXX		52	32	S	Normal	0	Schizophrenia
33	19.8.1929	XXX		55	22	S	„	0	Schizophrenia
34	10.2.1909	XXX		44	27	S	Not known	0	Depression; cerebral thrombosis
35	12.3.1916	XXX		60	24	S	Normal	0	Schizophrenia
36	28.4.1932	XXX	XXX	54	26	S	Irregular	0	Mental deficiency
37	16.7.1899	XXX		33	28	M	Normal	3	Paranoid schizophrenia
38	8.6.1908	XXX		47	18	M	„	0	Organic psychosis
39	9.10.1914	XXX		51	30	S	„	0	Mental deficiency; depression
40	30.8.1885	XXX		40	36	M	„	0	Senile psychosis
41	6.4.1922	XXX	XXX	38	50	S	„	0	Mental deficiency; schizophrenia
42	24.9.1941	XXX	XXX	44	36	S	„	0	Depression
43	18.9.1905	XX/XXX	XX/XXX	41	43	S	Normal	1	Schizophrenia
44	24.4.1890	XX/XXX	XX/XXX	52	32	M	„	1	Schizophrenia
45	23.8.1928	XO/XXX	XO/XXX	47	35	S	„	1	Mental deficiency; psychopathic
46	26.2.1913	XO/XXX	XO/XXX	33	51	M	„	1	Depression
47	1889	NO CULTURES		40	36	M	Not known	Not known	Senility; alcoholism

tained from 95% of the males and 89% of the female in-patients, and they are believed to be representative. If this is so, the approximate number of patients in the various diagnostic categories may be deduced by reference to the population on June 1, 1963. Thus 2895 males and 2017 females may be classified as schizophrenic, 479 males and 391 females as mentally defective, and 149 males and 141 females as epileptic. The incidence of abnormal nuclear sex chromatin in these groups is given in Table III.

Discussion

The results of previous sex chromatin surveys of male mental hospital populations have been reviewed by Hambert (1966) and are set out together with the results of the present investigation in Table IV. In all, 13,852 males were examined and 75 (0·54%) were chromatin positive. Three of the groups studied were composed of schizophrenic patients only, and 9 of these 878 men were chromatin positive (1·02%). If these three groups are, for the meantime, omitted from consideration, there is left a general mental hospital population of 12,974 males, which includes 66 chromatin-positive men (0·51%). This proportion of abnormalities is higher than the 0·22% incidence found in 4 independent sex chromatin surveys of newborn boys (Maclean, 1966), and the difference is highly significant ($\chi^2 = 17·6$).

A number of factors may be concerned in this increase in chromatin-positive males in the general mental hospital population, and the first and most obvious is mental deficiency. Mental hospitals in Scotland and apparently also in Sweden (Hambert, 1966) contain a proportion of mental defectives, and it is estimated that 479 male mental defectives were included in the present survey. Among them were 10 chromatin-positive males (2·09%), an incidence which is even higher ($\chi^2 = 6·4$: $0·02 > p > 0·01$) than that in 11,613 males in mental deficiency institutions (Ferguson-Smith, 1966). Although the

TABLE III

ESTIMATED INCIDENCE OF ABNORMAL SEX CHROMATIN IN PATIENTS RESIDENT IN MENTAL HOSPITALS IN SCOTLAND

Diagnostic Group	Males			Females		
	Estimated No. in Group	Chromatin Positive		Estimated No. in Group	2 Sex Chromatin Bodies	
		No.	%		No.	%
Mental deficiency	479	10	2·09	391	4	1·02
Epilepsy	149	3	2·02	141	0	0·00
Schizophrenia	2895	11	0·38	2017	6	0·30
Other diagnoses	2477	6	0·24	3692	5	0·14
All groups	6000	30	0·50	6241	15	0·24

TABLE IV
SEX CHROMATIN SURVEYS OF MALES IN MENTAL HOSPITALS

Authors	Hospital Population	Country	No. Examined	Chromatin +ve	
				No.	%
Carr, Barr, and Plunkett (1961)	General mental	U.S.A.	254	1	0·39
Jagiello (see Polani, 1961)	Schizophrenic	England	530	5	0·94
Tedeschi and Freeman (1962)	,,	U.S.A.	248	3	1·21
Raphael and Shaw (1963)	,,	U.S.A.	105	1	0·95
Nielsen (1964)	General mental	Denmark	450	5	1·11
Hambert (1966)	,,	Sweden	6265	30	0·48
Present survey	,,	Scotland	6000	30	0·50
Combined total			13,852	75	0·54

number of mental defectives in the present series is comparatively small, the difference may be real and may be brought about by selection. Many considerations have to be taken into account in the administrative disposal of mental defectives in need of institutional care; the degree of mental impairment, stability of personality, coexistence of psychosis, and the availability of vacant hospital beds, among others. In the present series the diagnosis of mental deficiency was unqualified in only 4 of the 10 men who were chromatin positive. In 6 there were additional disturbances: schizophrenia in 2; mania in 2; cerebral arteriosclerosis in 1, and alcoholism in the other. These may have been the main factors determining the admission of these patients to mental hospitals, but it is also possible that the level of intellectual development may have influenced their disposal, only the least handicapped being admitted to mental hospitals. There is evidence to suggest that such selection could affect the incidence of sex chromatin abnormalities. Thus in an analysis made by one of us (W.M.C.B.) of published data, the incidence of chromatin-positive males in mental deficiency institutions was found to vary inversely with the degree of intellectual impairment: 0·22% when the IQ was less than 20; 0·90% when the IQ fell between 20 and 49; and 1·5% when it was over 50. In a survey of 336 boys in educationally subnormal schools in Zurich, Prader *et al.* (1958) found an even higher incidence in the children in the IQ range 75–85. 8 were chromatin positive (2·38%) and had a mean IQ of 79.

Epilepsy may be another factor that influences the incidence of chromatin-positive males in a mental hospital. Hambert (1964) found 4 chromatin-positive cases among 512 males in a Swedish institution for epileptics, and in the present survey 3 of the chromatin-positive males occurred in an estimated population of 149 male epileptics (2·0%). These are findings that suggest that there is an association between the effect of additional X chromosomes in males, and mental disease, and epilepsy, but their significance needs to be tested further by study of large populations of chromatin-positive males, and by observations on epileptics not in need of institutional care.

Schizophrenia may be the third factor causing an excess of chromatin-positive males in mental hospitals, and it is one that gives rise to problems in evaluation. Hambert (1966) stresses the difficulty of precise diagnosis if schizophrenic-like disorders occur in patients with Klinefelter's syndrome, and doubts whether the term schizophrenia has much validity in this context. Schizophrenia in association with Klinefelter's syndrome has, however, been described by Money and Hirsch (1963) and by Bond and Margulies (1964), and the results of the surveys of schizophrenic patients noted in Table I suggest that the incidence of sex chromatin abnormalities in illnesses so diagnosed is of much the same order as that in mental deficiency. In the mental deficiency surveys reviewed by Ferguson-Smith (1966), for example, the incidence of sex chromatin abnormalities in 11,613 male mental defectives was 0·84%.

In the present series, 11 of an estimated 2895 males said to be suffering from schizophrenic-like illness were chromatin positive (0·38%), and in addition, 2 of the chromatin-positive male mental defectives were also thought to be suffering from schizophrenia. 13 chromatin-positive males were therefore detected among approximately 2900 patients with schizophrenic-like disorders, an incidence that is approximately double that in the newborn male population, and that differs significantly ($\chi^2 = 7{\cdot}0$: $p = 0{\cdot}01$) from that of the newborn males in the Edinburgh survey (see Table VI).

The evidence at present available, therefore, suggests that there is an increase in the incidence of abnormal sex chromatin in schizophrenic males as compared with the general population, even when allowance is made for imprecision of diagnosis. Whether this increase is especially related to

TABLE V

SEX CHROMATIN SURVEYS OF FEMALES IN MENTAL DEFECTIVE INSTITUTIONS

Authors	Country	No. Examined	No. with 2 Barr Bodies	Sex Chromosome Constitutions			
				XXX	XX/XXX	XO/XXX	Others
Fraser *et al.* (1960)	Scotland	595	4	4	—	—	—
Johnston *et al.* (1961)	U.S.A.	827	3	3	—	—	—
Breakey (1961)	N. Ireland	140	—	—	—	—	—
Sanderson and Stewart (1961)	Scotland	240	1*	—	—	—	—
Hamerton, Jagiello, and Kirman (1962)	England	196	2	2	—	—	1 X + isochromosome of X long arms
Maclean *et al.* (1962)	Scotland and England	1907	8	7	1	—	1 XO
Unpublished Edinburgh Observations	"	1477	12	9	1	2	1 XO/X + ring chromosome†
Breg *et al.* (1963)	U.S.A.	727	5	5	—	—	1 XO/XY
Davies (1963)	Wales	250	—	—	—	—	1 XXXX
De la Chapelle (1963)	Finland	1256	2	2	—	—	3 XO 1 XO/X + partly deleted X 1 XO/X + isochromosome of X long arms
Ridler, Shapiro, and McKibben (1963)	England	735	2	2	—	—	1 chromatin-positive female analysed because of clinical diagnosis of Turner's syndrome found to have XO/XX constitution
Anderson *et al.* (1964)	S. Africa	899	4	4	—	—	1 XO/X + fragment of Y (?)
Totals		9249	43				

* No chromosome studies made.
† Fisher (1965).

TABLE VI

INCIDENCE OF SUPERNUMERARY SEX CHROMATIN IN EDINBURGH POPULATION SURVEYS

Population	Males			Females			Male/female Ratio of Incidence of Supernumerary Sex Chromatin
	No. Examined	Chromatin +ve		No. Examined	2 Sex Chromatin Bodies		
		No.	%		No.	%	
Babies born in hospital or at home	12,456	23	0·18	11,653	12	0·10	1·80
Mental hospital patients	6,000	30	0·50	7,207	17	0·24	2·12
Mental deficiency institution patients	4,178	41	0·98	3,384	20	0·59	1·66

schizophrenia rather than to psychosis in general is more doubtful. In considering this problem it is relevant to compare the incidence of X chromosome abnormalities in schizophrenic patients with that in the residual hospital population, when the groups of schizophrenic, mental defective, and epileptic cases have been abstracted. There were 2477 males in this residual category in the present survey and 6 of them were chromatin positive (0·24%). This incidence, though lower than that in the schizophrenic group, does not differ from it significantly, either when the 11 cases with a primary diagnosis of schizophrenia are considered alone ($\chi^2 = 0{\cdot}31$), or when 2 mentally defective patients with schizophrenic features are also included ($\chi^2 = 1{\cdot}08$; $p = 0{\cdot}3$). There is a suggestion in our results, therefore, that the apparent association between schizophrenia and X chromosome anomalies in males may be mainly a reflection of a non-specific influence of the additional chromosome on the development of psychosis.

In females, abnormal sex chromosome complements other than those containing additional X chromosomes appear to play little part in causing mental abnormalities. None were encountered in the present investigation, and in 11 surveys including 7993 female mental defectives only 5 with an XO cell line were detected (Table V). The incidence was higher in De la Chapelle's survey (1963), but his experience must be regarded as exceptional. In general it may be said that chromatin-negative females are not much more common in mental deficiency institutions, and may be less common in mental hospitals than in the general population. Estimates of the incidence of X chromosome abnormalities in the general population are based mainly on surveys of newborn babies, and the Edinburgh experience may be taken as representative. The

surveys included 10,000 girls born in hospital (Maclean *et al.*, 1964) and 1653 girls born at home (unpublished data). No sex chromatin abnormality was detected in the latter group, and the incidence of chromatin-negative girls in the 11,653 newborn females is 0·03%, and of females with 2 sex chromatin bodies, 0·10%.

Females with an XXX cell line are overrepresented in mentally defective populations (Table V). 43 were detected among 9249 mentally defective females (0·46%), an incidence that is significantly higher than in the newborn. In the present survey, the incidence of the XXX constitution in the general mental hospital population (0·24%) fell between those of the newborn and the mentally defective.

Mental deficiency again appears to be responsible for part of the increased incidence of sex chromosome abnormalities in the female mental hospital population. Thus, in an estimated population of 391 mentally defective females, there were 3 with XXX sex chromosomes and 1 with XO/XXX cell lines. This incidence (1·02%) is even higher than that in mental defective institutions (0·46%) though the difference is not significant ($\chi^2 = 1{\cdot}68$; $p = 0{\cdot}2$). Epilepsy did not account for any of the excess of abnormal sex chromosome constitutions in women, but the estimated number of epileptics, 141, is small and therefore this negative finding is of doubtful significance. The diagnosis of schizophrenia, on the other hand, was prominent in women with abnormal sex chromatin, and 7 women were affected in this way. One of the mentally defective patients with XXX sex chromosomes was said to show schizophrenic features. Four other women with schizophrenia also had XXX sex chromosomes and 2 others had both XX and XXX cell lines. These abnormalities occurred in an estimated population of 2071 patients with schizophrenia, an incidence (0·34%) that is less than that in the mentally defectives but is significantly greater than that in the newborn females of the Edinburgh surveys ($\chi^2 = 5{\cdot}4$; $p = 0{\cdot}02$). The difficulty in assessing this finding in females is similar to that in chromatin-positive males. The propriety of making the diagnosis of schizophrenia in patients with abnormal sex chromosome constitutions has been called in question and Kidd, Knox, and Mantle (1963), in studying the mental disorders seen in association with additional X-chromosomes in women, and Hambert (1966) reviewing similarly affected males, preferred to analyse the disorders under symptom complexes. Nevertheless, there appears to be no doubt about the association of abnormal sex chromosome constitution with mental disturbance. Kidd *et al.* (1963), after examining a number of patients detected in the present survey and in a survey of mental defectives (Maclean *et al.*, 1962), called attention to the high incidence of psychosis in women with an XXX chromosome constitution, not only in mental hospitals but also in mental deficiency institutions. For the purpose of this discussion it is perhaps beside the point to attempt to differentiate between schizophrenia and other forms of psychosis in women, since the incidence of abnormal sex chromosome constitutions in patients diagnosed as suffering from schizophrenia does not differ significantly from that in the residual population (Table III), even when the mentally defective patient with schizophrenia is included ($\chi^2 = 1{\cdot}88$; $0{\cdot}2 > p > 0{\cdot}1$).

Hambert (1966) concluded that the main cause of the personality and behaviour disorders in Klinefelter's syndrome must be attributed to the effect of the chromosome imbalance in the cells of the cerebrum. Obviously the effect that additional X chromosomes have upon mental development places those affected in this way at a disadvantage in their family and social milieu, without necessarily causing severe mental retardation. In chromatin-positive males, the further disadvantage of testicular atrophy after puberty is added, and it is perhaps little wonder that a proportion of men with this double handicap fail to adapt themselves adequately to adult life. Hambert (1966) noted, in these patients, the prevalence of a passive-aggressive disposition, weak libido, and low intensity of personality, and in some of the psychotic patients, megalomania and short episodes of mania.

The influence of the additional X chromosome in women is probably less complex than in men, since gonadal abnormalities are comparatively rare in women with 3 X chromosomes except when an XO cell line is also present or when one of the X chromosomes is abnormal. In the present series, for example, menstruation and the external genitalia were normal in the majority of women with sex chromatin abnormalities (Table II). It is, therefore, relevant to compare the ratio of the incidence of the chromatin-positive males to that of females with 2 sex chromatin bodies in 3 Edinburgh population surveys (Table V), in an attempt to assess the influence of hypogonadism in initiating mental breakdown in chromatin-positive men. It will be seen that the ratios are similar in newborn babies, mental hospital patients, and the mental defectives. The more damaging karyotypes are, of course, concentrated in the mental deficiency group, and when males with more than one sex-chromatin body or with more than one Y chromosome are omitted from consideration the ratios become 1·71, 2·05, and 1·28, respectively. The M:F ratio, therefore, is

slightly higher in the mental hospital population, but the difference is insignificant. Similarly if gynaecomastia is taken as an index of the degree of hormonal disturbance in chromatin-positive males, it is found that it is commoner in such patients in mental hospitals than in mental deficiency institutions, but the difference is slight (Court Brown, 1967). Therefore, neither the difference in the incidence of gynaecomastia nor the difference in the M:F ratios in the various population groups with additional X chromosomes are such as to suggest that hypogonadism and its consequences play more than a subsidiary role in the pathogenesis of mental illnesses experienced by a proportion of chromatin-positive males.

The evidence, therefore, is suggestive that additional X chromosomes have a disturbing effect upon mental development, which is not restricted to intellectual maturation and is not mediated mainly through hormonal imbalance. But it remains to be decided whether the extra X chromosomes are alone responsible or whether they merely exaggerate inborn predispositions to mental illness determined by other factors. In Hambert's series, for instance, a history of mental instability was frequent amongst the relatives of chromatin-positive males. In the meantime, however, it seems reasonable to assume that additional X chromosomes play a significant part in initiating a variety of disturbances including mental deficiency, psychosis, and epilepsy.

Summary

The prevalence of sex chromatin abnormalities in 6000 male and 7207 female mental hospital patients was studied by means of the buccal smear technique. 30 of the men were chromatin positive, and 17 of the women had 2 sex chromatin bodies in some or all of their cells. None of the women was chromatin negative. Chromosome analyses were carried out on the patients with abnormal sex chromatin. At attempt is made to assess the influence of these abnormalities in the development of mental illness, and it is concluded that X chromosomes additional to the normal complement may play a significant part in initiating a variety of mental disturbances.

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